D.—INSPECTION OF MINES.

I.—General.

Inspector of Mines.

Mr. R. Bocquet, Inspector of Mines, was stationed on the Kolar Gold Field for practically the whole of the year under report with the exception of 15 days' privilege leave of absence from the 22nd February to 8th March 1910 (both days inclusive), during which period he was occupied on inspection work, investigating important accidents—fatal and serious—and with the general supervision of the work carried on in the office.

During the absence of Mr. L. H. Beckwith, Deputy Inspector of Mines, on 3 months' privilege leave, his work was carried out by Mr. Bocquet without prejudice to his own duties.

The Explosives Magazines on the field were, as usual, inspected at various times during this period and were found to conform to the provisions of the Explosives Rules the contents being in good order and correctly stored.

All prosecutions under the Mines Regulation for a breach of the Rules thereunder, whether resulting in accidents to the persons engaged in mining operations or not, were instituted and carried out by him.

Deputy Inspector of Mines.

Mr. L. H. Beckwith, Deputy Inspector of Mines, went on 3 months' privilege leave of absence from the 21st July 1909 and, in continuation thereof, the Dasara Holidays.

On returning to duty, he took over the examination of candidates for mestris and blasters certificates, for which two days a week were set apart owing to the large number of applicants. The remainder of his time was fully occupied in assisting in the work of inspection, investigation of fatal and serious accidents, both by inspection and enquiry, and enforcing the Mining Rules in conjunction with the Inspector of Mines.

Mining Assistant.

During the year in question, Mr. C. E. Suryanarayaña Rau, to gain experience, was given the majority of the minor accidents to enquire into and report upon, classed as serious by the medical authorities, of which there were a large number. He proved himself quite capable of carrying out the work entrusted to him, and with more experience in this line will be able to assist in the investigation of the more important accidents that occur.

Granted that the progress shown is maintained, his services should be of considerable use to this office staff.

Certificates. The following table shows the number of examinations held and certificates granted up to the end of the year:—

YEAR.	Mestris.		Blasters.	
	Number examined.	Number passed.	Number examined.	Number passed.
1901	...	...	530	501
1902	352	302	442	355
1903 to 30th June	460	437	166	153
1903-04	1,715	1,591	280	260
1904-05	769	763	144	144
1905-06	440	424	78	74
1906-07	614	614	552	551
1907-08	747	740	1,014	1,006
1908-09	660	659	596	594
1909-10	612	600	602	573
Total ...	6,369	6,130	4,404	4,211

Duplicate tickets (discs) to the number of thirty-six were also issued to mestris and eight to blasters, who had lost the originals held by them.

In two cases, two persons were prosecuted during the official year for using tickets belonging to other certificate holders. Both were convicted and sentenced to undergo ten day's rigorous imprisonment each.

Inspection Bungalow and Office. As no separate accommodation was provided for the office of the Inspector of Mines (*vide* Government Proceedings No. 1228-9, Geological, dated 23rd October 1908) the Deputy Inspector of Mines' quarters and the office are still located in the same building. This arrangement is unsatisfactory, the space required by the office staff and for the records, specimens, library, etc., being greatly curtailed, while the Deputy Inspector has only a portion of the building at his disposal, which deprives him of much of the privacy he would otherwise enjoy.

The Inspector of Mines continued to reside in the Inspection Lodge assigned to him as his official quarters during the previous official year, while rent was levied from the 1st July 1909 on both the buildings referred to above, at the rate of 5% per mensem on the salary (including allowances) of the two officers mentioned.

II.—Labour Employed.

The number of persons employed in the Mining Industry in 1909 was 30,663 as against 32, 614 in 1908, showing a decrease of 1,951.

Of this number, 28,873 were employed in Gold mining, 1,698 in Manganese mining, 30 in Chrome mining and 62 in Mica mining.

Of the 28,873 employed in Gold mining, 556 were Europeans, 357 Eurasians and 27,960 Indians, a total of 17,612 being employed on underground work and 11,261 on surface work.

III.—Accidents.

(*a*) Statistics for the year 1909.

The total number of accidents reported during the year 1909 was 427 as against 431 during the year 1908.

Of these accidents:—

69	were fatal.
347	were serious.
11	were slight (including non-mining).
Total... 427	

The total number of fatal and serious accidents was therefore 416, being at the rate of 13·57 per 1,000 persons employed.

The corresponding figures for the year 1908 were 421, a rate of 12·91 per 1,000 persons employed.

Of the above 416 separate accidents :—

33	or 7·93 per cent were due to negligence.
56	or 13·46 per cent were due to recklessness.
327	or 78·61 per cent were due to unavoidable causes.

The corresponding figures for the year 1908 are :—

22	or 5·226 per cent due to negligence.
42	or 9·976 per cent due to recklessness.
357	or 84·798 per cent due to unavoidable causes.

In the 69 fatal accidents of the year, 114 persons were killed, which gives a mortality of 3·72 per 1,000 employed as against a mortality of 2·76 per 1,000 employed during the year 1908.

The death-rate in the Gold Mines, which employed the greater proportion of the labour, was 3·64 per 1,000 against 3·08 in 1908.

These figures are disappointing when compared with those of the previous year showing an increase of 0·58 per 1,000 due chiefly to the fact that in nine accidents alone, no less than 47 persons were killed, or 41·23 per cent of the total fatalities. The usual details of some of the more serious accidents are given below according to their character and whether they show any features of interest ; these include the nine accidents mentioned above.

There were 15 fatal accidents during the year which involved the loss of two or more lives, 59 persons altogether being killed in these 15 cases or 51·75 per cent. of the total number of fatalities.

Of these 15 accidents :—

6 or 40·00 per cent were due to negligence.
4 or 26·67 per cent were due to recklessness.
5 or 33·33 per cent were due to unavoidable causes.

Five of the above accidents were due to air-blasts, three to misfires and the rest to miscellaneous causes including the fall of the side of an open working from the bottom of which manganese ore was being excavated against orders ; no less than eight people were buried and suffocated in this accident alone. (A short description of this accident was given in last year's report).

Air-blasts and quakes accounted for 14 fatal accidents during the year 1909, in which the number of persons killed totalled 31 ; one accident alone accounted for no less than 12 of these fatalities and is dealt with below in the notes on accidents.

In the same period there were nine accidents due to explosives involving the loss of 14 lives, which, compared with the previous year, gives the same number of fatalities for an increase of two in the actual number of cases reported due to this cause in which persons were killed.

(*b*) Notes on Important Accidents.

The same method has been adopted regarding the statistics and notes on accidents in this report as in the one preceding it, i.e., the statistics refer to the calendar year 1909, while the notes deal with the official year 1909-10.

1.—Air-Blasts and Quakes.

Of the accidents due to this cause, from the point of view of the number of persons killed, by far the worst which has yet been recorded occurred at the Champion Reef Mine on the 15th September 1909 in a small stope below the 7th level, Ribblesdale's Shaft.

The stope, 20 feet long in a pillar double that length, had reached a depth of 26 feet below the 7th level, its average width being 3 feet and that of the quartz 1½ feet. The stope was close timbered to within 7 feet of the working face, but a couple of pieces were still required to complete the bottom row of props ; a small box filled with waste rock had been constructed from the ladderway in the centre of the stope to the shoot pass at the north end.

There were no signs of heavy ground, systematic timbering having been adopted solely as a precautionary measure. From the evidence obtained, without the slightest warning a tremendous upheaval took place accompanied by a loud report and the splitting of timbers and cracking of the surrounding rock, all lights being immediately extinguished ; the shock was both heard and felt on surface.

From the appearance of the place immediately after, as described by the Italian foreman and the hand jumper mestri, the stope looked as if it had been completely filled from end to end up to the floor of the 7th level. As there was no possible chance of getting at the men, known to be in it, from this level, the shoot pass, leading from the stope into the level below, was opened and the stuff allowed to run ; two coolies came down on the top of it slightly cut and bruised. The Italian with a timber mestri then climbed up the pass with a rope, at considerable personal risk, and found four more coolies at the top, one of whom was seriously injured ; these were all lowered safely into the level, but no more were to be seen.

After more than 60 hours' strenuous labour which was carried out under the most hazardous and trying conditions, the last of the bodies was recovered, twelve persons in all being killed. The Chief Mine Agent and all concerned deserve special commendation for the manner in which this dangerous task was accomplished.

After a portion of the debris had been cleared from the 7th level, an inspection of the stope was made, but owing to the confined area, broken rock and timbers still littering the place added to the temporary supports put in to catch up the shattered hanging-wall, it was difficult to carry out a very thorough examination. However, it was seen that the two bottom rows of props had been broken and the hanging-wall so shaken for the whole length of the lower portion of the stope, that large quantities of it had fallen, the rock burying the men just below without allowing them the slightest chance of escape.

The stope, which before was only 3 feet wide, now measured 11-12 feet across from hanging to footwall at this point, giving some idea of the effect of the quake and the amount of rock displaced.

On reaching the end of ground still standing intact, south of the stope, it was found that the quartz forming the pillar had been so crushed that it had become a friable mass, large quantities of which could be removed by hand. The rails of the tram road laid on the floor of the 7th level, immediately over the pillar, had also been raised several feet, a sure indication that the reef had been badly crushed at this point. It was impossible to find out to what extent the rest of the pillar had suffered, as the reef on both sides of it had been worked out and filled in, but it can safely be surmised that the effect was the same owing to its limited proportions.

The result of the inspection goes to show that this accident was due to the sudden fracture of the pillar of quartz then being stoped, and was not a fall of the hanging-wall on account of insufficient support. All precautions had been taken to secure the hanging-wall by timbering and filling with waste rock—measures which would have been amply sufficient under all ordinary circumstances.

The total length of the pillar being only 40 feet, it was decided to abandon stoping operations in this locality for some time to come and orders were accordingly issued to this effect.

This forms a very good example of what is defined as a quake, in contrast to the better known and more widely used term air-blast. The difference between these phenomena is described on page 32 of the Chief Inspector of Mines' Report for 1908-09, and from this it will be seen that the above is a typical case of superincumbent pressure on a portion or pillar of ground which had been left intact in the midst of a stoped out area.

There were many cases of accidents due to air-blasts, which unfortunately resulted in the loss of life, and in attempting to offer an explanation to show the difference between "quakes" and "air-blasts", one has been taken which occurred in a shaft where the superincumbent pressure due to the weight of the overlying rock could have been very small compared with that where much stoping has been done.

This occurred on the 9th September 1909, in Tennant's Incline Shaft, Champion Reef, just below the 31st level. The angle of inclination of the shaft is 60 with the horizontal and outside of the cross-cut driven from the shaft to communicate with the 31st level, no other workings existed near it, and the nearest stoping was several hundred feet above this horizon.

The shaft at this point happens to be 90 feet west of the reef in the hanging-wall; the pressure, if any existed, ought therefore to have made itself felt in the 31st level driven along the run of the reef. Instead of that, the only place affected when this air-blast took

place, the shock of which was felt at the 29th level, was the hanging-wall of the shaft, 15-feet above the sink. Here the rock was so shaken and split up, that several pieces of it fell, striking the persons clearing stuff in the sink, of whom one was killed, one seriously hurt and seven others injured.

The walls of the shaft and ends of ground had been thoroughly examined and tried for "loose," but of this there was very little, the hanging-wall being particularly sound and clean.

Although this portion of the shaft was not then timbered, yet, I am satisfied that the fall of ground was due to internal strain in the rock, which reached such a point that the air-blast took place and caused masses of it to be shaken down.

As usual the Champion Reef Mine was the greatest sufferer from these phenomena, 312 shocks being recorded during the year, of which 116 were classified as being "heavy" and 100 "very heavy," 33 doing damage to the underground workings, necessitating the carrying out of repairs of a more or less extensive character.

2.—Winding Accidents.

Rope Breaking.

Accidents due to this cause are fortunately of very rare occurrence, the quality of the ropes used being of a high standard, while systematic examination, when regularly and carefully carried out, also accounts to a large extent for the immunity enjoyed by this Field from such occurrences.

However, a disastrous accident was the result of the rope snapping while the hoisting of stuff was in progress at Rowse's Shaft, Mysore Mine, on the 27th September 1909. The skip had been filled from the 1260 foot level shoot and rung away. It had only been hoisted a short distance when it suddenly came down again and went direct to the bottom of the shaft—then sinking below the 3020 foot level—killing six persons and seriously hurting another.

The shaft is underlie throughout, the angle of inclination being about 68° from surface to the 1160 foot level, after which it gets flatter varying from 35° at the 1620 to 41° at the 2920 foot level. Doors are provided at each of the stations, which, while the hoisting of stuff is in progress from the shoot above, are supposed to be kept shut.

R. H. Cox, the stuff-miner in charge and C. Madurai, M. 2137, his mestri, state that when they started work that night, they first went to the 2920 shoot to see how much stuff was there, after which they shut the doors at the 2920 plat—put for the purpose of protecting persons working below—and then started hoisting stuff from the 2820 shoot. On finishing this, they shut the doors at the 2820 plat, cleared the 2720 shoot, then opened the doors at the 2820, shut those at the 2720 and proceeded to clear the 2620 shoot, and so on up the shaft. After shutting the doors at the 1620, they cleared the 1520 shoot and then went up to the 1260 leaving the doors at the 1620 shut; those at the 1460 were not closed, as they were not provided with counterweights.

The first trip from the 1260 resulted in the breaking of the rope, which parted at a point about 70 feet above the skip.

Directly after the accident, Cox and his mestri climbed down the shaft and found the north door at the 1620 plat smashed, the skip passing through it. At the 2920 the corresponding door was open, although he says he left it shut, while the south door was still shut; the mestri corroborated this statement in detail.

The engine—an electrical hoist—and part of the shaft were inspected the same morning. The indicator showed that the ascending skip had reached a point some 50 feet above the 1160, while in the shaft a lot of quartz had been thrown out about there on to the footwall and timbers. The rope had evidently broken when the skip was somewhere above the 1160.

The shaft was examined from the 1000 down to the 1460 foot levels. No obstruction of any description was found, nor was there any trace on the shaft timbers or runners indicating that the skip had jammed, the skip-road being in perfect order. The driver of the electric hoist states that he noticed nothing and was only aware that something had happened when the rope, instead of being tightly coiled round the drum as usual, suddenly became slack. It may be assumed from this that the skip did not get jammed in the road on this particular trip, otherwise some damage must have been done to and marks made on the wooden runners.

On going down to the 1460 foot level plat to see whether the door over the north road had been shut, it was found open and chained up and had evidently not been closed any time during the shift. From information received subsequently, it would appear that all the doors below this point had been left open at the time of the accident.

In view of Cox's statement, the door at the 1620 plat was carefully examined. It consists of two wooden runners hinged to the edge of the plat and joined together by an iron plate. The plate had been bent and torn away and another substituted; neither of the runners was in the least damaged except at the points where the iron plate had been torn away, and it is quite obvious that, had the doors been shut, one or both runners must have been smashed by the falling skip.

This was pointed out to Cox and every opportunity given him to amend his statement, but he still adhered to it even when confronted with facts which made it patent that the door must have been open when the skip passed down the shaft.

He was prosecuted for negligence, but acquitted on the assumption that the door could easily have been opened by some person or persons unknown after Cox had shut it and left the place to hoist stuff from the 1260. It was impossible to bring forward evidence to prove the contrary.

Taking the angle of the shaft into consideration at this point (35°), it is more than probable that, had the door been shut, the skip would have run out on to the plat instead of going to the bottom of the shaft and consequently no one would have been injured.

The rope was made of steel wire, $1\frac{1}{8}$" diameter, and, when new, its breaking strain was given as 48 tons. It had been in use since September 1908, changed end for end in February 1909, and three times re-capped in May, August, and September 1909—3, 10, and 4 feet being cut off on these occasions respectively.

It is examined daily and the entry in the book made the day before the accident states, that it was in good order. The assistant engineer who examines it every week, in his report dated two days before, made a similar entry.

The rope broke 70 feet above the skip and the broken ends appeared to be sound with clean fractures and a very fair reduction of area. The wires were evenly worn on the outside but not excessively. After being put into operation, the rope had hauled just over 25,000 tons of stuff while 3600 turns of timber had been sent down; this is nothing out of the common for such a rope.

A series of tests were made on the wires of a sample of this rope taken close to the point of fracture. Those that were worn had an average breaking strain of 1172 lbs. each, and the unworn wires gave a result of practically 1 ton. There are 36 working wires (6 strands of 7 wires each; omit the central core wire of each strand) and by a close inspection of the rope, it was estimated that 3 wires in each strand were worn and 3 unworn. From the above tests, this would give a breaking strain of 27·4 tons.

The results of tests made by the College of Engineering, Madras, on a sample of the rope as a whole, taken from just above the point of separation, gave the breaking strain at 31·75 tons.

It was calculated that the maximum load, excluding friction, with a full skip at the bottom of the shaft would be about 3·35 tons.

With a breaking strain of 27·4 tons, the factor of safety works out at just over 8, while taking the breaking strain to be 31·75 tons, the factor of safety is approximately 9·5 tons.

However, when the rope broke, the skip was at, or about, the 1160 feet level where the angle of the shaft is 68°. The total load works out at this point to be 2·25 tons, which gives a factor of safety of over 12 and 14 respectively, according to the relative breaking strains quoted above.

The Mining Rules lay down that ropes used for winding persons shall have a factor of safety of not less than 10 when new, and the Transvaal Rules say that the factor of safety must not at any time be reduced below 6.

It is evident that the rope in question was still strong enough to satisfy the requirements for winding persons, which are naturally more exacting than when stuff only is being hoisted, which was the case at Rowse's shaft,

So far as one can tell therefore the rope was amply good enough for its work and had been properly and carefully looked after, and, although it is impossible to be certain in such matters, the evidence points strongly to some other cause than failure of the rope under working conditions.

The only conclusion to arrive at is, that the skip, for some unknown reason, got hitched against something a little above the 1160 level, though no trace or marks could be found of its having done so, and that, as the hoist continued working, it snapped the rope. As stated before, the engine driver noticed no unusual strain, but as the hoist is worked by an electric motor, this can be accounted for, as it is possible he would not notice a strain to the same extent as in the case of a steam-engine.

How the skip got hitched up, if such a thing happened, is a mystery. The road and shaft timbers were in very good order, while 68 skips of stuff had already been safely hoisted that night before the accident took place.

In the shaft itself doors are provided, and had they been closed as they ought to have been, and as they are stated to have been, the falling skip would, in all probability, have been thrown out of the shaft and the loss of life averted.

3.—Miscellaneous.

Of the accidents due to explosives causing fatalities, all were proved to be the result of either recklessness or negligence on the part of the mestris and blasters concerned. The persons responsible, if not killed, were either prosecuted and fined, or had their certificates suspended, according to the merits of the case. The latter appears to be the best method of punishment, as the men are reduced to the rank of an ordinary cooly and consequently get less pay.

No comment is necessary on the accidents themselves.

IV.—Prosecutions.

(*a*) In connection with thefts, etc., of Mining materials.

The following statement shows the number of cases dealt with during the year 1909 as compared with 1908, by the Assistant Commissioner and First Class Magistrate, Kolar Gold Field, in connection with thefts and illegal possession of mining materials under Section 6 of the Mysore Mines Regulation :—

Year.	Number of cases.	Number of persons put up.	Number of persons convicted.	Value of property recovered.
				Rs. A. P.
1909	188	270	213	2,630 14 4
1908	117	169	116	3,825 5 7

The following table shows the various kinds of mining materials in respect of which prosecutions were instituted during the year 1909 :—

Kinds of Material	Number of offences dealt with.	Number of persons charged in each case.	Number of convictions.	Value of property recovered.
				Rs. A. P.
Gold quartz ..	82	110	83	879 4 0
Auriferous tailings	25	56	46	90 10 0
Mercury	2	4	1	0 6 0
Amalgam ...	7	12	9	73 0 0
Sponge gold	7	9	6	1,143 2 0
Bar gold	4	5	3	19 8 0
Cyanide gold	..	..	...	...
Iron pyrites	...	.	...	...
Explosives	10	12	10	97 5 0
Explosives* .	...	...	...	2 4 1
Tools	36	48	39	310 15 6
Wood ..	17	21	20	11 4 0
Candles	4	3	3	3 3 9
Total ..	194	280	220	2,630 14 4

* Explosives found by the Police and confiscated in Court, but for which no person was chargeable.

(*b*) In connection with Accidents, Breach of Rules, etc.

The following is a comparative statement for the three years 1907, 1908 and 1909 :—

	1909	1908	1907
Number of cases	37	37	33
Number of persons put up	41	40	38
Number of persons convicted	29	34	29
Number of persons acquitted	11	4	8
Number of persons discharged...	..	2	...
Number of persons not found	...	...	...
Number of cases pending	1	...	1

Of the above, 10 cases were put up under the Indian Penal Code and 27 under the Mysore Mines Regulation. The penalties in the cases of conviction ranged from fines of Rs. 2 to Rs. 75 and imprisonment from 10 days to one year.

During the year, 17 persons were prosecuted for breach of the provisions of the Mines Regulation and Rules thereunder in cases resulting in accidents; 10 persons were convicted, 6 were discharged and 1 absconded.

In two cases not resulting in accidents, 2 persons were prosecuted and both were convicted for a breach of the above Rules.

For less serious offences, 41 persons were departmentally punished by the Superintendents of the various Mines as recommended by the Chief Inspector and Inspectors of Mines. The penalties inflicted ranged from fines to dismissal, while in minor cases a warning was considered sufficient.